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ABSTRACT

This study investigated children's performance with the passive-transformation when both the mode of presentation and the mode of response were verbal. The study was also designed to provide a framework for the examination of theoretical issues regarding strategies in speech perception. Kindergarten and first-grade children individually heard 6 sentences all in the same voice and all either harmonious with or contrary to children's previously expressed expectations regarding the likely actor in the sentences. After each sentence the child heard a question about the content of the sentence. The score for each child was the number of questions answered correctly. Results of this study support the hypothesis that children do not rely exclusively on any single sentence processing strategy. Instead, they combine their knowledge of the world, of words, and of language in the perception of speech. The results also indicate that an exclusively verbal mode of presentation and response is quite difficult for children. (Author/GO)

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The Passive Transformation on its O.n

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ABSTRACT

Children in kindergarten and grade one do not rely exclusively on any single sentence processing strategy. Instead, they combine their knowledge of the world, of words, and of language, in the perception of speech. The results of this investigation of children's comprehension of the passive transformation suggest that: 1) when children initially grasp the meaning of an utterance, they can answer a question about that utterance regardless of the syntactic complexity of the question; 2) a statement which is difficult is not made any less difficult by an easier question; and 3) an easier statement is not complicated by a more difficult question.

The Passive Transformation on Its Own

INTRODUCTION

Background and Purpose.

Differences in children's performance on active and passive sentences and questions, both singly and in combination, have been reported in several studies (for example, Fraser, Bellugi, & Brown, 1963; Maratsos, 1974; Menyuk, 1963a, 1963b; Noval and Ambrosino, 1973; Turner and Rommetveit, 1967a, 1967b, 1968). These differences have been further qualified in other studies describing the influence of children's role expectations on their performance with the passive transformation (Gowie and Powers, 1972; and Powers, 1973-74). Reversibility (Slobin, 1966) and probability (Hutson and Powers, 1974) have also been identified as factors affecting children's comprehension of passive-voice sentences. Either pictures or objects often served as stimulus materials, along with two or more combinations of sentence and/or question voice.

In studies of children's language, three major kinds of responses have been considered as evidence of comprehension: 1) in a picture-choice situation, the child points to the picture described by the experimenter's statement (e.g., Kessel, 1970; Kramer, Koff, and Luria, 1972); 2) the child manipulates objects so that they match the conditions expressed by the experimenter's statement (e.g., C. Chomsky, 1969; Huttenlocher, Eisenberg, and Strauss, 1968); and 3) the child responds verbally, saying what the experimenter directs (e.g., C. Chomsky, 1969). While the first methodology does not thoroughly control for extraneous cues, the second does not control for effects due to the perceived actor and the logical

subject (Gowie, 1973). Providing the child with pictures and/or objects does not correspond to most actual speech settings. Furthermore, it introduces temporary sources of information yielding temporary or contingent probabilities which may not reflect the child's own estimates of probability.

The purpose of this study was to investigate children's performance with the passive-transformation, given exclusively verbal stimuli. Both the mode of presentation and the mode of response were verbal, thus involving the psycholinguis[illegible]bilities of listening and speaking. The study was also designed to provide a framework for the examination of theoretical issues regarding strategies in speech perception (Bever, 1970; Maratsos, 1974; and Wright, 1969).

Rationale.

Bever (1970) has proposed several strategies which may be employed in processing sentences. Two of those strategies are relevant to this study:

> "Strategy C: Constituents are functionally related internally according to semantic constraints (p. 296)."
>
> and
>
> "Strategy D: Any Noun-Verb-Noun (NVN) sequence within a potential internal unit in the surface structure corresponds to 'actor-action-object' (p. 298)."

Strategy D could be applied to active-voice sentences, such as, "The policeman warns the man," resulting in correct processing or understanding. As Bever (1970) notes, however, passive-voice sentences do not meet the assumptions underlying Strategy D. The passive-voice sentence, "The man is warned by the policeman" may appear to be a NVN sequence, but the surface structure does not correspond to the sequence

actor-action-object. Thus, if Strategy D is applied, the result will be misinterpretation of the message.

Children learn typical patterns of the language before learning the exceptions (C. Chomsky, 1969). The Minimum Distance Principle, for example, is applied to all sentences with the appropriate surface structure well before children and some young adults learn that it is to be violated in certain instances (C. Chomsky, 1969; Cowie, 1973; Kessel, 1970; Kramer, Koff, and Luria, 1972). Similarly, just as we observe overgeneralization regularization of the rules describing tense markers (e.g., walk → walked, and come → comed) when children are learning to indicate tense (Ervin, 1964) we might expect to observe overgeneralization of Strategy D, finding that children employ that strategy before they learn that it is to be violated in the case of passive sentences.

Strategy D requires reliance on syntactic information. Strategy C, in contrast, requires reliance on semantic information. The listener must have a wealth of knowledge about the world in order to estimate semantic probabilities accurately.

Bever (1970) suggests that Strategy C is used whenever possible (296), and that Strategy D is employed when we have no basis for prediction, that is, in "understanding sentences in which there are no differential semantic probabilities (p. 298)." A more difficult condition, one not dealt with by Bever, would result when the listener must process a sentence containing a message which contradicts his or her best estimate of probability. "The dog is bitten by the man" would be an example of such a contrary sentence. If a person used only Strategy C, he or she would think that the dog bit

the man; similarly, exclusive reliance on Strategy D would lead to the same misinterpretation. When processing a contrary passive-voice sentence, one must refer to the syntactic structure as a source of necessary information.

Bever further proposes that children between the ages of two and six years depend in their linguistic behavior on perceptual generalizations (p. 305). Strategy C would be employed sometime during the third year, and, shortly thereafter, Strategy D would be more commonly used for understanding sentences without semantic constraints (pp. 306-307).

In an attempt to refute Bever's (1970) claim regarding the dominance of behavioral strategies in speech perception, Maratsos (1974) argues for the greater significance of basic linguistic capacities. These capacities, according to Maratsos, appear to be "basic to language functioning at all times" (p. 73). Whereas the behavioral strategies, such as C and D, require knowledge both of the world and of the language, basic linguistic capacities require only linguistic competence (Maratsos, 1974, p. 73). Maratsos seems to argue that these capacities must be dominant during the period between age two and age six on the basis of two propositions: (1) that behavioral strategies require knowledge, and implicitly, (2) that children during these years could not possess enough knowledge of their language and their world to support the formulation of behavioral strategies (p. 72).

Problem.

Kindergarteners and first graders heard and responded to statements and questions in the active and passive voice. To incorporate a variable related to Strategy C, the stimulus materials were constructed to be harmonious with, or contrary to, children's previously expressed expectations regarding the likely actor in the sentences. Thus, questions about harmonious sentences could be answered on the basis of semantic probabilities (i.e., Strategy C), whereas this strategy would lead to incorrect answers regarding contrary sentences. Furthermore, Strategy D could successfully be employed with the active-voice materials, but not with those in the passive voice. This design is based on the assumption, (contradictory to Maratsos), that children at age five and six do have a fund of knowledge about language and the world sufficient to provide a basis for predictions or expectations about both. Elsewhere (Gowie and Powers, 1972) it has been noted that kindergarteners and first graders have "surprisingly definite" (p. 7) expectations regarding the usual or most common actor and recipient of the action when they are shown pictures of pairs of animals and are asked, for example, "Would the turtle kick the frog, or would the frog kick the turtle?" Furthermore, children in K, 1, and 2 hold expectations not only about behavior typically associated with particular roles, (e.g., mothers bake cakes more often than fathers), but also about people, events, and actions which adults might not anticipate (e.g., Sue promises Nancy to push the swing vs. Nancy promises Sue) (Gowie, in press). Therefore, the stimulus materials were designed to incorporate children's expectations.

A comment is in order regarding the sentences employed as stimulus materials. Wright (1969) investigated adults' comprehension of active- and passive-voice sentences, finding that most errors were made when statement voice and question voice were different. Her sentences, which are listed in Table 1, seemed to the present experimenters to reflect semantic probabilities that were far from being equal, however. It seemed possible that the differences among the semantic probabilities of the items could account for the errors as reasonably as could the syntactic "mismatch" between statement and question voice.

METHOD

Expectations.

A random sample of 40 children, 20 in kindergarten and 20 in grade one, was selected from a suburban elementary school and employed to determine children's expectations about the six potentially reversible sentences used by Wright (1969). The children were interviewed individually by the experimenters and asked which noun in each of the six pairs they thought would usually be the actor in each situation. These results are presented in Table 1.

Notice in the table that children in kindergarten and grade one often differed in their expectations about which noun would be the actor. This is especially true in sentence 3, where kindergarteners show a distinct preference for a nurse to help a doctor, and first graders are essentially neutral. It can also be seen in sentences 2 and 6, where there is a distinctly stronger preference in grade one, although the directionality of expectation is the same in both grades.

Table 1

Children's Expectations Regarding the Six Sentences Used by Wright (1969)

Sentence	Kindergarten	Grade One
1. A cat would watch a bird.	15	18
A bird would watch a cat.	5	2
2. A child would thank a teacher.	11	14
A teacher would thank a child.	9	6
3. A nurse would help a doctor.	16	8
A doctor would help a nurse.	4	12
4. A policeman would warn a man.	20	20
A man would warn a policeman.	0	0
5. A boy would follow a girl.	11	8
A girl would follow a boy.	9	12
6. A fox would see a rabbit.	13	18
A rabbit would see a fox.	7	2

Construction of Sentences.

Using the information shown in Table 1, sentences were constructed in both the active and passive voice. Within each voice, sentences were either harmonious with, or contrary to, expectation in each. A harmonious sentence for a particular grade was simply one in which the noun identified as the usual actor by the majority of children in that grade was indeed the actor in the sentence. A contrary sentence was one in which the less likely or expected noun became the actor. Although the same noun pairs were used in both grades, the actual sentences differed whenever expectations were different in the two groups. Also, even though several of the sentences are essentially neutral in one or both of the grades, all sentences were classified as either harmonious or contrary, depending on the directionality of expectation.

As an example of sentence construction, consider sentence 3. For kindergarteners, a harmonious, active-voice sentence was, "The nurse helps the doctor," whereas a contrary, active-voice sentence was, "The doctor helps the nurse." This same sentence in grade one yielded a harmonious, active-voice sentence as, "The doctor helps the nurse," and a contrary, active-voice sentence as, "The nurse helps the doctor." Similarly, sentence 4 furnished a harmonious, passive-voice sentence for both grades as, "The man is warned by the policeman," and a contrary passive for both grades by simply reversing the positions of the two nouns.

Procedure and Design.

A random sample of 192 children, 96 in kindergarten and 96 in grade one, was selected from three suburban schools comparable to the school employed to determine expectations. In each grade the children were

further assigned randomly to eight groups of 12 each. Each child in each of the resulting 16 groups individually heard six sentences, all in the same voice and all either harmonious or contrary to expectation. After each sentence, the child heard a question about the content of the sentence. All questions were also in the same voice for each child, though not necessarily in the same voice as the statements. The score for each child was the number of questions answered correctly.

The design was therefore a 2^4 (grade by sentence voice by question voice by expectation) factorial analysis of variance.

RESULTS

The results of the overall analysis of variance are presented in Table 2.

Sentence Voice.

Inspection of the means of the significant main effect of sentence voice shows that children performed better on active sentences (mean = 4.14) than on passive sentences (mean = 3.10).

Expectation.

For the significant main effect of expectation, inspection of the means shows that children performed better when sentences were harmonious with expectation (mean = 4.04) than when sentences were contrary to expectation (mean = 3.20)

Grade by Question Voice.

The four means in the significant grade by question voice interaction were further analyzed by the least significant difference procedure (Winer, 1971). The results of this analysis are given in Table 3 and a sketch of the interaction is presented in Figure 1. The analysis of this

Table 2

Analysis of Variance

Grade by Sentence Voice by Question Voice by Expectation

Source	Degrees of Freedom	Mean Squares	F
Between grades (G)	1	3.25	1.32
Between sentence voices (S)	1	51.04	20.66**
Between question voices (Q)	1	.88	<1
Between expectations	1	34.17	13.83**
G X S	1	7.14	2.89
G X Q	1	12.51	5.06*
G X E	1	2.30	<1
S X Q	1	.42	<1
S X E	1	.64	<1
Q X E	1	1.17	<1
G X S X Q	1	7.13	2.89
G X S X E	1	.24	<1
G X Q X E	1	0	<1
S X Q X E	1	3.80	1.54
G X S X Q X E	1	2.30	<1
Error	176	2.47	
Total	191		

*$p < .05$

**$p < .001$

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Figure 1

GRADE BY QUESTION INTERACTION

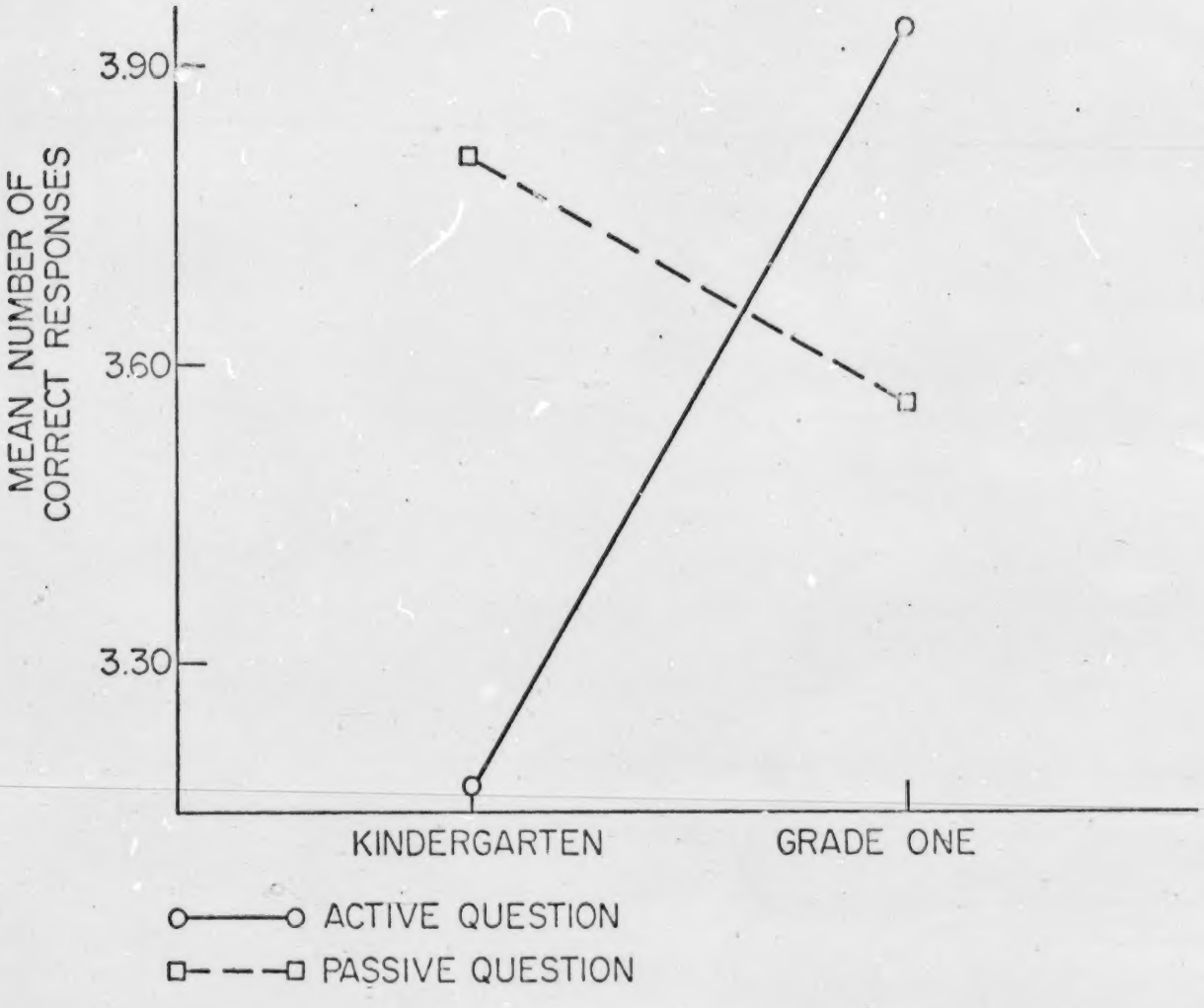

Table 3

Significantly Different Means in the Grade by Question Voice Interaction[1]

Treatment Combination	Mean
Kindergarten-Active question	3.17
Grade one-Passive question	3.56
Kindergarten-Passive question	3.81
Grade one-Active question	3.94

1. The first mean in the bracket is significantly different ($p < .05$) from all means outside of the bracket, but not from other means contained in the bracket, using the least significant difference procedure.

interaction shows that kindergarteners performed significantly better on passive than on active questions, while first graders performed identically in the two voices. In addition there was a significant improvement in performance on active questions between kindergarten and grade one, whereas there was no change in performance on passive questions.

Other Interactions.

Two other interactions, although not reaching the usually accepted level for significance of $p < .05$, are sufficiently close to that level to warrant discussion. These are the grade by sentence voice and the grade by sentence voice by question voice interaction, both of which reach significance at $p = .09$. Both of these interactions were further analyzed with $p \leq .10$ to determine the trends within them.

Grade by Sentence Voice.

The least significant difference procedure was employed to investigate the grade by sentence voice interaction. The results of this analysis are given in Table 4 and a sketch of the interaction is shown in Figure 2. First graders performed significantly better on active sentences than did kindergarteners. Generally, however, both groups had higher mean scores on active than on passive sentences. There was no significant difference between the two grades' mean scores on passive sentences.

Grade by Sentence Voice by Question Voice.

Since there were eight means in the three-way interaction of grade by sentence voice by question voice use of the least significant difference procedure was not feasible. Subsequent analysis of this interaction was conducted using Scheffé's procedure (Winer, 1971). The significant differences

Table 4

Significantly Different Means in the Grade by Sentence Voice Interaction[1]

Treatment Combination	Mean
Grade one-Passive sentence	3.04
Kindergarten-Passive sentence	3.17
Kindergarten-Active sentence	3.81
Grade one-Active sentence	4.46

1. The first mean in each bracket is significantly different ($p < .10$) from all means outside of that bracket, but not from other means contained in that bracket, using the least significant difference procedure.

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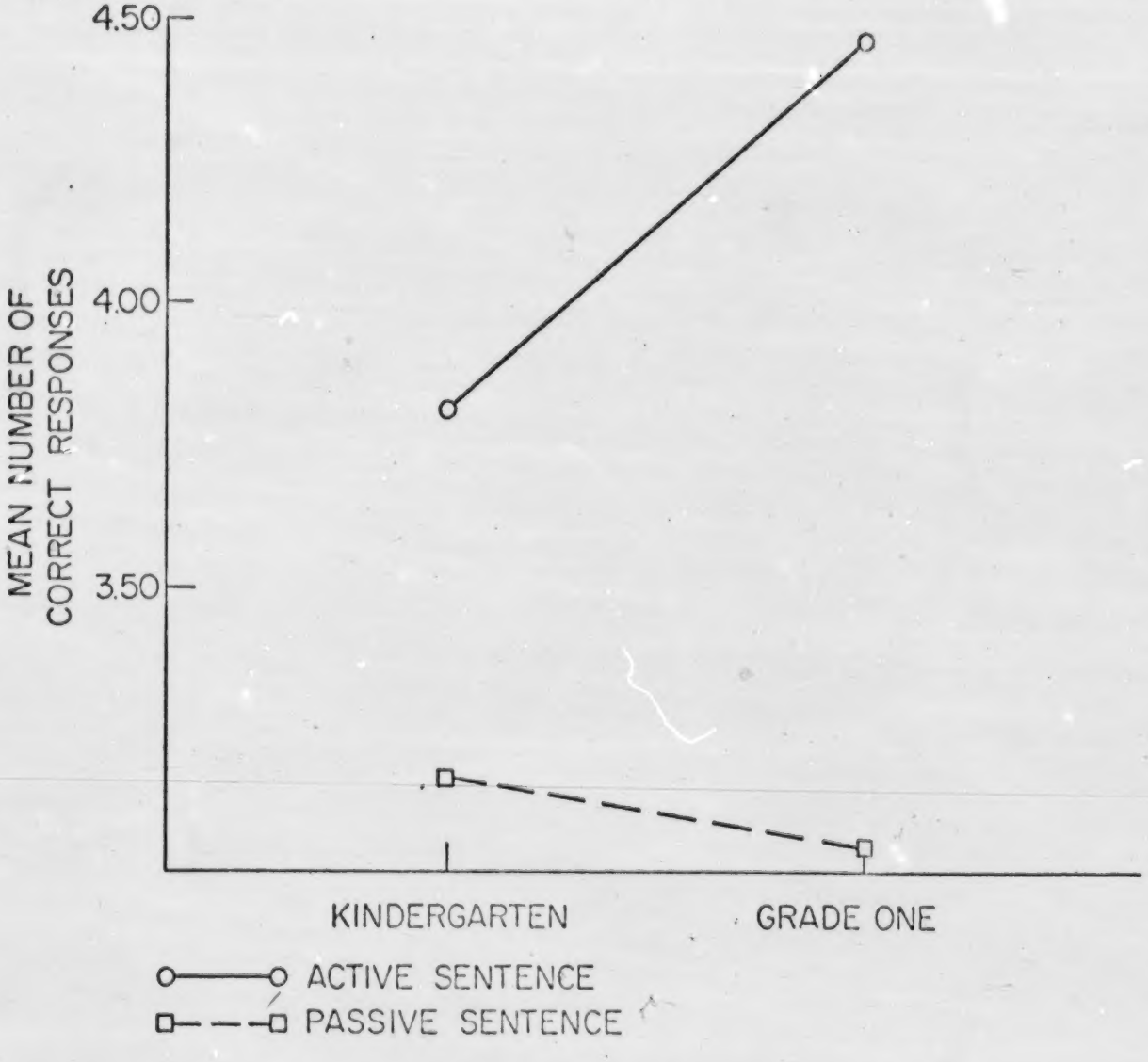
GRADE BY SENTENCE INTERACTION



found are presented in Table 5 and a sketch of the interaction is shown in Figure 3.

Seven of the eight means fit a general pattern, showing that children in both groups performed less well on passive sentences than on active sentences, regardless of question voice. The eighth mean is an exception to this pattern: in kindergarten the mean score in the active/active combination is not significantly different from the means of the passive/active and passive/passive combinations.

The four mean scores on passive sentences are not significantly different. Such similarity is not observed in the case of active sentences, however. Although first graders performed at the same statistical level in the active/active and active/passive combinations, kindergarteners did not. The younger children produced a higher mean score in the active/passive condition than in the active/active condition.

Finally, there was no difference in performance on active questions regardless of sentence voice in kindergarten, whereas there was in grade one. Among the older children, performance was better when an active question was preceded by an active rather than a passive sentence. Both grades performed better on passive questions preceded by active rather than passive sentences.

DISCUSSION

Sentence Voice.

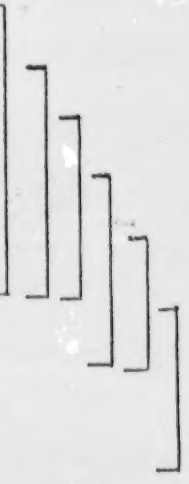
The significance of sentence voice, especially in conjunction with the non-significance of question voice, seems to suggest that when children initially grasp the meaning of an utterance, they can answer questions about

Table 5

Significantly Different Means in the Grade by Sentence Voice by Question Voice Interaction[1]

Treatment Combination

Grade	Sentence Voice	Question Voice	Mean
One	Passive	Passive	3.00
One	Passive	Active	3.08
Kindergarten	Passive	Active	3.08
Kindergarten	Passive	Passive	3.25
Kindergarten	Active	Active	3.25
One	Active	Passive	4.13
Kindergarten	Active	Passive	4.38
One	Active	Active	4.79



1. The first mean in each bracket is significantly different ($p < .10$) from all means outside of that bracket, but not from other means contained in that bracket, using Scheffé's procedure.

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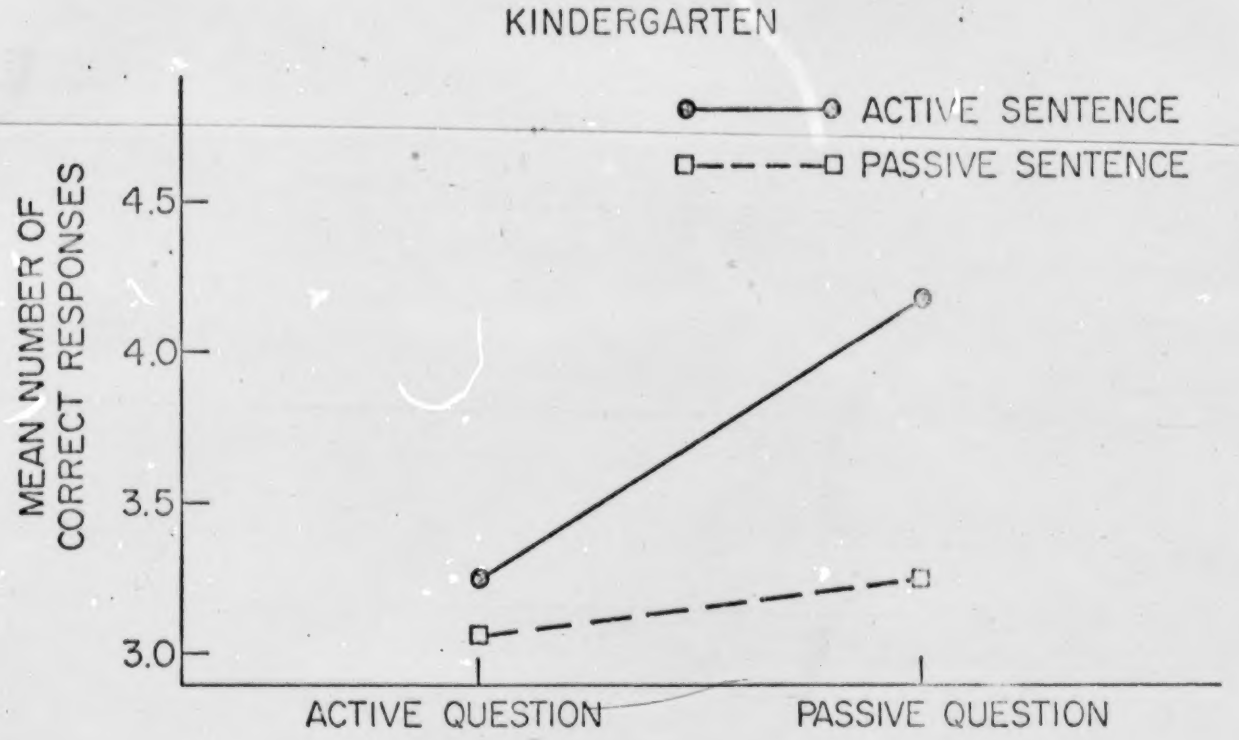
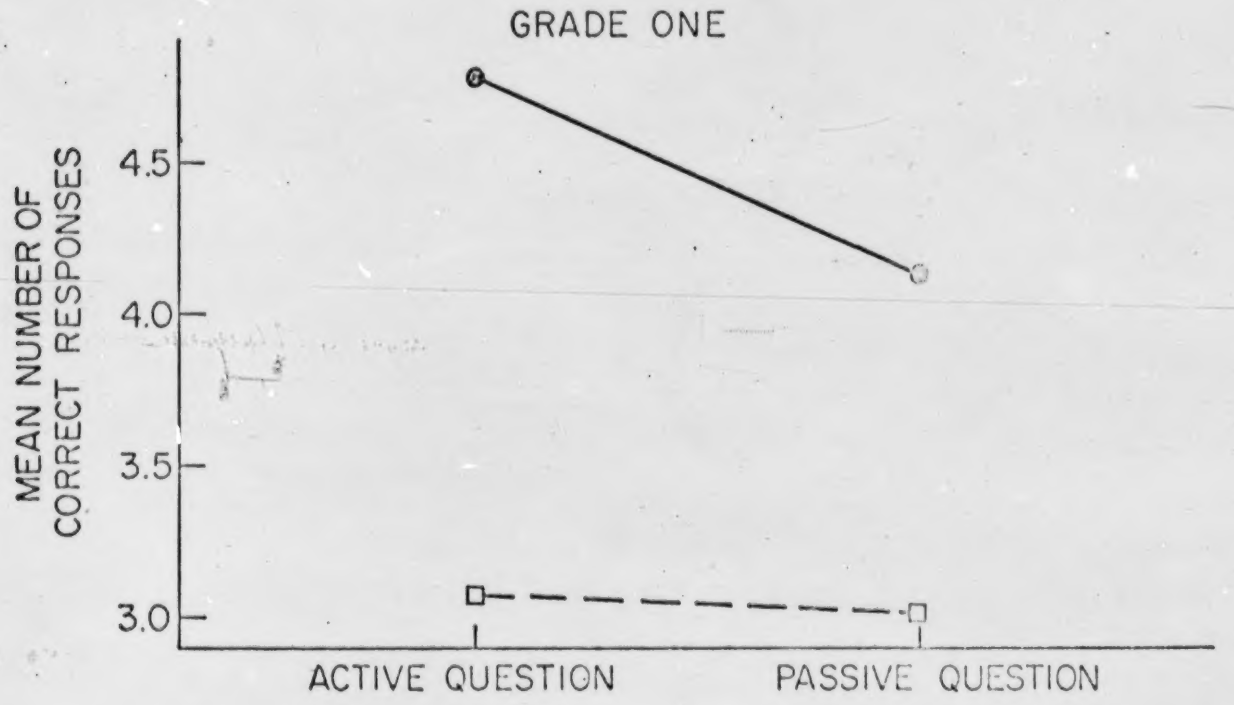
Figure 3

GRADE BY SENTENCE BY QUESTION INTERACTION





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that utterance regardless of the syntactic complexity of the questions. Question voice was not significant. Strict interpretation leads to the conclusion that active voice questions were not easier than passive-voice questions. This would seem to refute Wright's (1969) statement that "active questions about passive sentences will be answered more easily than passive questions about active sentences (p. 156)."

The theoretical basis for Wright's (1969) statement is the hypothesized necessity of "de-transforming" passive-voice statements or questions in order to understand them. That idea, which has not gone unchallenged, is described by Hayes (1970) as the "Correspondence Hypothesis," since it directly relates psychological complexity to derivational complexity. Validation of this idea would require a significant statement by question interaction. However, in the present study, that interaction is clearly insignificant [F (1, 176) < 1].

Expectation.

If children responded to these experimental materials exclusively on the basis of Strategy C, then they would be correct each time the statements were harmonious with expectation, and incorrect each time they were contrary. Although this is not entirely the case, there was a significant difference between harmonious and contrary items [F (1, 176) = 13.83, $p < .001$]. Semantic probability does affect speech perception.

Furthermore, the significance of the effect of expectation contradicts Maratsos' (1974) implicit assumption that children's expectations are not yet sufficiently formed by these ages to allow them to employ Strategy C effectively. In this experimental setting, children relied on entirely generic or constant probabilities, since there were no objects or pictures

to furnish cues about contingent or temporary probabilities. There were no pictures of a man warning a policeman, or of a policeman warning a man; there were no toy cats or birds to manipulate. Children simply had to rely on their previously acquired knowledge of these potential actors. In the experimental setting children were asked to refer to this knowledge, then to judge probabilities and to apply the results of their judgments in comprehending the sentences. Clearly, children in kindergarten and grade one possess knowledge of their language and world which they can apply quite efficiently in speech perception.

Grade by Question Voice.

Examination of the grade by question voice interaction (see Figure 1), shows that kindergarteners answered significantly more passive questions than active questions, whereas first graders manifested no such significant difference. Viewed from another perspective, this interaction shows improvement on active-voice questions from grade to grade, but no significant change on passive-voice questions. With reference to the results of the least significant difference test, active questions about passive sentences were as difficult for kindergarteners as passive questions about active sentences were for first graders. Also, the kindergarten mean for active questions was significantly lower than all other means in this interaction. This is not due to kindergarteners' greater confusion on passive sentences followed by active questions, since the means of both grades in that condition are 3.08. Therefore, the greater difficulty experienced by kindergarteners, somehow, is due to the active/active combination, in which their mean score (3.25) was significantly lower than the first graders' mean (4.79).

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Would Strategy D help clarify the difference? Application of Strategy D would lead to correct answers when both statement and question were active, to incorrect answers in active/passive and in passive/active combinations, and to correct answers (for incorrect reasons) when both statement and question were passive. This is not consistent with the actual pattern of responses. Neither is it consistent with the order of difficulty based on derivational complexity.

Grade by Sentence Voice.

Children in both grades performed approximately equally on passive sentences, responding correctly only about half of the time (mean = 3.10). There was no improvement from kindergarten to grade one. Children in these grades demonstrated no significant competence with passive-voice statements---a mean of 3.00 would be predicted on a six item binary task if responses were on a random basis.

It is somewhat surprising to find a significant difference between the grades in their performance on active-voice sentences. This difference can be best explained within the framework of the grade by sentence voice by question voice interaction.

Grade by Sentence Voice by Question Voice.

As was just noted, performance on passive sentences was relatively consistent across grades and question voices. Performance on active sentences was not so consistent. In kindergarten, means in the active/active and passive/active combinations were statistically equal, whereas in grade one the mean of the active/active combination was significantly higher than the mean of the passive/active combination. It is, therefore, impossible that kindergarteners were employing Strategy D, since that strategy would yield success

in active/active combinations. First graders' higher mean in the active/active condition may at first seem to allow for the possibility that they were using Strategy D, but this possibility must be viewed with great skepticism. If that strategy were being employed, then children would be successful with the passive/passive combination. However, both kindergarteners and first graders had higher means in the active/passive than in the passive/passive combination. Therefore, the children do not seem to be employing Strategy D as an approach to processing these particular sentences.

First graders' and kindergarteners' mean scores in the passive/active and passive/passive combinations fell within the same critical range. This suggests that a statement which is difficult is not made any less difficult by an easier question. Conversely, when the statement is easier, it is not complicated by a more difficult question: the first grade means in the active/active and active/passive conditions, as well as the kindergarten mean in the active/passive condition all fell within the same critical range.

It is curious that the mean scores in the passive/passive and active/active conditions were identical in kindergarten (mean = 3.25). Perhaps the children were treating these two combinations in the same manner. Reference to Strategy D might also explain the equality of the means, but it does not explain why the means are not significantly different from the chance level (3.00).

The only scores which are significantly above chance are the three highest means: 1) grade one, active/passive; 2) kindergarten, active/passive; and 3) grade one, active/active. It may be important to note that none of the mean scores falls below 3.00. This could suggest that

the children are not using any strategy, not even an incorrect one, when attempting to process passive-voice statements. It is possible that they are in a transitional stage, sensing that something is different about the passive transformation, but not yet knowing how to respond to the difference. Only further research will lead to clarification of this question.

Methodology.

In many of the studies cited earlier, objects or pictures were provided for the children to use in demonstrating their understanding of the sentences. In such a setting, the child has contextual or situational cues to support his or her sentence processing. In this experiment, the children had nothing to rely on except their own knowledge. This knowledge consists of syntactic relationships and semantic probabilities. The semantic probabilities are based on their experience and their understanding of that experience (e.g., policemen usually warn men, rather than the reverse. That is, the children had to arrive at an understanding of the "message" of each sentence by way of their own mental representation of their world, their lexicon, and their grammar. This task is much more difficult than processing speech, given the support of actual perceptual events, such as objects or pictures.

CONCLUSIONS

Children in kindergarten and grade one did not rely exclusively on any single sentence processing strategy. The result that active statements were easier than passive statements may at first seem to support Bever's (1970) Strategy D. However, analysis of the interactions disclosed that Strategy D was not employed, at least not consistently. The result that

harmonious statements were easier than contrary statements supports Strategy C. No evidence was found to lend credibility to Maratsos' (1974) argument for the primacy of basic linguistic capacities as opposed to Bever's behavioral or perceptual strategies. Furthermore, the results weaken the foundation of the Correspondence Hypothesis, which does not include the importance of semantic sources of information.

This study suggests that kindergarteners and first graders combine their knowledge of the world, of words, and of language, in the perception of speech. The results also indicate that an exclusively verbal mode of presentation and response is quite difficult for children.

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